BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

CLAIMS

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. An apparatus for sensing a magnetic field by the giant magnetoresistive effect (GMR) comprising:

a plurality of magnetic stripes spaced apart on the upper surface of a substrate such that the stray fields at the ends of said magnetic stripes provide a magnetostatic coupling which magnetizes said magnetic stripes in alternating directions in a zero magnetic field,

a nonmagnetic conductive material positioned in the spaces between said magnetic stripes to form a conductive path between respective stripes, and

means for detecting the change in resistance through said plurality of stripes and conductive paths as a function of the magnetic field applied to said magnetic stripes.

2. The apparatus of claim 1 wherein said magnetic stripes are spaced apart at least 100Å.

3. The apparatus of claim 1 wherein said magnetic stripes have respective longitudinal axes which are substantially parallel.

4. The apparatus of claim 1 wherein said magnetic stripes comprise a soft magnetic material.

5. The apparatus of claim 1 wherein said magnetic stripes are positioned side by side.

6. The apparatus of claim 5 wherein said ends of said magnetic stripes are magnetically connected by transverse magnetic stripes which function as permeable "keepers".

7. The apparatus of claim 1 wherein said magnetic stripes have a cross-sectional area of less than 1000Å^2.

8. The apparatus of claim 1 wherein said nonmagnetic conductive material is selected from the group consisting of a nonmagnetic metal, alloys thereof, and a nonmagnetic compound formed from an element of said magnetic stripe.

9. The apparatus of claim 1 wherein said means for detecting includes means for applying electric current through said plurality of stripes and conductive paths therebetween.

10. The apparatus of claim 6 wherein said transverse magnetic stripes are electrically insulated from said magnetic stripes.

11. The apparatus of claim 1 further including a head and magnetic disc operating system for storing and retrieving data wherein said apparatus is mounted in said head.

12. A method for fabricating a magnetic field sensor comprising the steps of:

selecting a single crystal substrate having a surface at an angle between 1 and 10° away from a major crystallographic plane,

annealing said single crystal substrate to produce atomic scale steps on said surface,

depositing a ferromagnetic metal selected from the group consisting of Fe, Co, or Ni or alloys thereof onto said surface to form a plurality of ferromagnetic stripes adjacent respective steps, overcoating said ferromagnetic stripes and said surface with a nonmagnetic metal, planerizing said nonmagnetic metal to form alternating regions of magnetic and nonmagnetic metals on said surface, and forming electrodes on either side of said plurality of ferromagnetic stripes for passing a current through said plurality of ferromagnetic stripes.

13. An apparatus for sensing a magnetic field by the giant magnetoresistive effect (GMR) comprising:

a first plurality of magnetic stripes spaced apart on the upper surface of a substrate,

a nonmagnetic conductive material positioned in the spaces between said first plurality of magnetic stripes to form a conductive path through said plurality of magnetic stripes,

a second plurality of magnetic stripes spaced apart, said second plurality of magnetic stripes overlapping and transverse to said first plurality of magnetic stripes to provide a magnetic flux path to adjacent magnetic stripes of said first plurality of magnetic stripes whereby adjacent magnetic stripes of said first plurality of magnetic stripes in the region between said second plurality of magnetic stripes are magnetized in alternating directions in a zero magnetic field, and

means for detecting the change in resistance through said first plurality of magnetic stripes and conductive paths as a function of the magnetic field applied to said first plurality of magnetic stripes.

14. The apparatus of claim 13 wherein said first plurality of magnetic stripes are spaced apart at least 100Å.

15. The apparatus of claim 13 wherein said first plurality of magnetic stripes have respective longitudinal axes which are substantially parallel.

16. The apparatus of claim 13 wherein said first plurality of magnetic stripes comprise a soft magnetic material.

17. The apparatus of claim 13 wherein said first plurality of magnetic stripes are positioned side by side.

18. The apparatus of claim 17 wherein said second plurality of magnetic stripes function as permeable "keepers" and are substantially parallel.

19. The apparatus of claim 13 wherein said first plurality of magnetic stripes each have a cross-sectional area of less than $1000Å^2$.

20. The apparatus of claim 13 wherein said nonmagnetic conductive material is selected from the group consisting of a nonmagnetic metal, alloys thereof, and a nonmagnetic compound formed from an element of said magnetic stripe.

21. The apparatus of claim 13 wherein said means for detecting includes means for applying electric current through said first plurality of magnetic stripes and conductive paths therebetween.

22. The apparatus of claim 13 wherein said second plurality of magnetic stripes are electrically insulated from said magnetic stripes by an insulating layer therebetween.

23. The apparatus of claim 13 further including a head and magnetic disc operating system for storing and retrieving data wherein said apparatus is mounted in said head.

24. An apparatus for sensing a magnetic field by the giant magnetoresistive effect (GMR) comprising:

a layer of ferromagnetic material on the upper surface of a substrate,

said ferromagnetic layer having a plurality of nonmagnetic regions therein whereby magnetic flux paths may form around each one of said plurality of nonmagnetic regions at times said ferromagnetic layer is in a zero magnetic field, and

means for detecting the change in resistance through said layer of ferromagnetic material as a function of the magnetic field applied to said layer.

25. The apparatus of claim 23 wherein the diameter of said plurality of nonmagnetic regions is less than 350 nm.